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The Effect of Pre-operative Exercises, Education and Pain Control for Patients Undergoing a Total Hip Arthroplasty

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The Effect of Pre-operative Exercises, Education and Pain Control for Patients Undergoing a Total Hip Arthroplasty

Disciplines

Physical Therapy

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CRITICALLY APPRAISED TOPIC

Title: The Effect of Pre-operative Exercises, Education and Pain Control for Patients Undergoing a Total Hip Arthroplasty.

Clinical Scenario: The patients who led us to investigate this question are those we treated in the acute setting post-op, and then saw a few days later in an outpatient clinic. A number of these patients experienced a decrease in their overall function and they had many limitations due to pain. Some patients improved and returned to function much quicker than others, and our question explores whether pre-operative rehabilitation training can affect the functional recovery of patients post total hip arthroplasty.

Brief Introduction: The purposes of our clinical question is to gain insight as to whether research has demonstrated efficacy of using a pre-operative physical therapy protocol to enhance the recovery process for patients receiving a total hip arthroplasty compared to standard post-operative treatment and care.

My Clinical question: Do pre-operative exercises and/or education for patients undergoing a total hip arthroplasty improve recovery rates, improve function and decrease pain more than post-operative rehabilitation alone?

Clinical Question PICO:

Population – The population of the topic will be patients undergoing a total hip arthroplasty.

Intervention–The intervention will provide exercises and/or education prior to a total hip arthroplasty.

Comparison–The comparison group will be patients who do not receive a pre-operative plan.

Outcome–The outcome will be measured by the Harris Hip Score, the Visual Analog Scale (VAS), and functional assessments (sit to stands, ascending and descending stairs, supine to sit).

Overall Clinical Bottom Line:

Based on the results of the outcomes from Ferrara *et al.*, Gocen *et al.*, and Vukomanovic *et al.*, preoperative physical therapy and intervention does not improve recovery rates, decrease pain or improve function as compared to post-operative physical therapy alone, in patients undergoing a total hip arthroplasty. However, preoperative physical therapy and education may be beneficial in promoting quicker returns to function immediately post-operation.

All groups receiving preoperative physical therapy were able to return to functional activity much quicker than groups receiving post-operative therapy alone. However, there were no long term differences in terms of hip function. Only one study, Ferrara *et al.* resulted in a significant decrease in pain for patients with preoperative therapy as measured by the VAS, as compared to the control group. The other two articles did not show a difference in pain scores.

Regardless of the outcomes of these studies, further research is required to answer the question of whether preoperative therapy is truly beneficial. All three articles had relatively different treatment protocols, thus further research can be conducted to show which treatment protocol would be most beneficial. Another question that could be further researched, is: how long preoperative physical therapy should be conducted, prior to the operation.

Search Terms: total hip arthroplasty; total hip replacement; hip surgery; rehabilitation; physical therapy; pre-operative exercise; pre-operative; prehabilitation; THA; THR; early rehabilitation; physiotherapy

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Rationale for your chosen articles

The search process for these articles included using electronic databases and online services. Some of these databases included CINAHL, Web of Science, etc. These articles were chosen based on the criteria involving preoperative planning for a total hip arthroplasty procedure. We then compared the respective articles based on abstracts and methodology, PEDro scores, and similar outcome measures (VAS and Harris Hip Score).

1. Ferrara, PE; Rabini, A; Aprile, I; Maggi, L; Piazzini, DB; Logroscine, G; et al. Effect of pre-operative physiotherapy in patients with end-stage osteoarthritis undergoing hip arthroplasty. *Clinical Rehabilitation*. 2008, 977-986.
 - PEDro Score: 6/10
 - Patient: The patients in this study were similar to our patients as it was indicated for them to have a total hip arthroplasty.
 - Intervention: Strength and flexibility training (particularly of hamstrings, hip adductor/ abductors and flexor muscles), use of recumbent stationary bike, postural realignment and advice on movement that should be avoided, and the use of devices(crutched, elevated toilet seat, elevated beds and foreceps to help dressing)
 - Outcome measures: Range of motion at hip, disability using Barthel Index,

health-related quality of life using Short Form-36 (SF-36), Impairments using the WOMAC and evaluation of pain using VAS.

2. Gocen, Z; Sen, A; Unver, B; Karatosun, V & Gunal I. The effect of preoperative physiotherapy and education on the outcome of total hip replacement: a prospective randomized controlled trial. *Clinical Rehabilitation*. 2004, 353-358.
 - PEDro Score: 6/10
 - Patient: Patients in this study were similar to our patients as it was indicated for them to have a total hip arthroplasty.
 - Intervention: Educational program (movements to be avoided, posture, lifting/carrying, ADLs); straight leg raise; stretching of hamstrings and hip flexors; upper extremity exercises
 - Outcome measures: Harris Hip Score; VAS; day which patient started to walk, ascent/descent stairs, and transfer; hip abduction ROM only

3. Vukomanovic, A; Popovic, Z; Durovic, A & Krstic, Ljiljana. The effects of short-term preoperative physical therapy and education on early functional recovery of patients younger than 70 undergoing total hip arthroplasty. *Vojnosaniteski Pregled*. 2008, 291-297.
 - PEDro Score: 4/10
 - Patient: Patients in this study were similar to our patients as it was indicated for them to have a total hip arthroplasty; there is an extensive list for inclusionary/exclusionary criteria.
 - Intervention: one appointment with physiatrist; two classes with physiotherapist
 - Outcome Measures: VAS; ROM; Harris hip score; Japanese Orthopaedic Association hip score; Oxford hip score with functional assessment (supine to side lying, supine to sit, sit to stand, standing, back to bed, walking on crutches, use of toilet, sitting on chair, ascent/descent of stairs)

Table 1. Comparison of PEDro Scores

	Ferrara et al.	Gocen <i>et al.</i>	Vukomanovic <i>et al.</i>
Random	X	X	X
Concealed allocation	-	-	-
Baseline comparability	X	-	-
Blind Subjects	-	-	-
Blind Therapists	-	-	-
Blind Assessors	X	X	-
Adequate Follow-up	-	X	X
Intention-to-Treat	X	X	-
Between Group	X	X	X
Point Estimates & Variability	X	X	X
Total Score	6/10	6/10	4/10

Article: Ferrara et al. 2008

Clinical Bottom Line:

Preoperative education and physical therapy prior to receiving a total hip replacement is beneficial for a reduction of pain, however is not beneficial in terms of hip function. The study group received an intensive physical therapy and education protocol (five hours of therapy per week for four weeks), while the control group received no preoperative physical therapy or education. However, both groups received the same postoperative rehabilitation protocol. There was no difference between groups in terms of hip function, as measured by the Harris Hip Score. However, the minimal clinically important difference (MCID) of seven points¹ was met within groups. There was a significant reduction of pain ($p < 0.05$) from baseline to three months post-operation and the MCID was also met within groups (19 mm), as measured by the visual analog scale (VAS).

There were some threats to internal validity including lack of blinding of the subjects and therapists, lack of concealed allocation, and an inadequate follow-up. We believe that the most significant threat to the study was the inadequate follow-up, as the authors only evaluated patients up to three months post-operatively. Through our experience, total hip arthroplasties require at least 6 months to one year to reach full recovery. We do not believe that these threats to the study affected the external validity. The cost of the treatment outweighs the benefits. Although there was no significant improvement in return to function, there was a significant decrease in pain, which is an important consideration to the patient.

Article PICO:

Population— The patients used in this study had end-stage osteoarthritis and were on the waiting list for a total hip arthroplasty.

Intervention— The intervention used was preoperative education and physiotherapy one month prior to the surgery.

Comparison— The comparison group/control group received no intervention and remained on the waiting list for one month.

Outcomes— The outcome measures used were the Barthel Index, Short Form-36, Western Ontario and McMaster Osteoarthritis Index, Harris Hip Score, Visual Analog Scale (VAS), and British Medical Research Council measures of hip abductor and quadriceps strength, and range of hip abduction and external rotation.

Blinding:

The authors of the study did not blind the subjects or the therapists. Due to the nature of this study design, it would be very difficult to blind the subjects. The authors state that the therapists involved with preoperative and postoperative treatment were the same people, thus blinding did not occur. However, the authors did state that the outcome measures were administered by two physicians and research assistants who were blinded. We do not believe that the lack of blinding of the subjects or therapists significantly affected the study. Since the assessors were the ones executing outcome measures, results should not have been affected as they were blinded.

Controls:

The control group did not receive any preoperative education or physical therapy. They were required to remain on the waiting list for an additional month. The control group received the same postoperative treatment as the study group. The control group was an appropriate comparison group as they were similar at baseline.

Randomization:

The assignment of subjects to groups was randomized. Specific inclusion and exclusionary criteria had to be met prior to starting the study. Randomization was not concealed but we do not believe that this was a significant threat to the study. Groups were formed successfully as the authors state that the two groups were similar at baseline.

Study:Study Design:

The study was a randomized controlled trial comparing the effects of preoperative education and physical therapy to a standardized rehabilitation protocol for patients undergoing a total hip arthroplasty.

Subjects:

The study included a total of 23 patients who were qualified to be subjects in this study, 11 in the study group and 12 in the control group. These patients were required to be affected by primary end-stage osteoarthritis and on the waiting list for a total hip arthroplasty. Exclusionary criteria for patients included Parkinson's disease, neuropathy, inflammatory arthritis (RA or SLE), use of any prosthetic devices, congenital hip dysplasia, and a Mini-Mental State Examination with a score of less than 24. The study group received an intensive physical therapy schedule and education prior to the total hip arthroplasty; they participated in physical therapy five days per week, for 40 minutes in small groups and 20 minutes individually with the physiotherapist, for four weeks.

The patients in the control group did not receive any treatment prior to their surgical procedure. Both groups received the same postoperative physical therapy treatment protocol in inpatient rehabilitation.

Outcome Measures:

The outcome measures used that are relevant to our clinical PICO were the VAS and the Harris Hip Score (HHS). Outcome measures were evaluated one month before the surgery (T0), the day before surgery (T1), up to 15 days after surgery (T2), four weeks after surgery (T3), and three months after surgery (T4). The VAS is consistent to be a reliable and valid measure of pain. Although the authors did not state the MCID for the VAS, Lee et al (2003) set the MCID at 19 mm. They also do not state the MCID for the HHS, however Achen et al (2010) set the MCID at 7 points, on a 0-100 point scale. The HHS appears to have face validity as it is a measurement of hip functionality. The assessors were blinded. The authors did not address the inter-rater and intra-rater reliability of the assessors.

Study Loss:

Two of the 23 patients in the study were lost, both in the control group. An intention-to-treat analysis was not performed for the study losses. We do not believe that an intention-to-treat analysis was necessary to accommodate for the loss. However, visual analysis of the data shows that the authors included the two patients lost from the study in the T4 analysis. This data could be skewed because the authors did not have accurate information from the subjects lost. The authors did not state whether they conducted an intention-to-treat analysis.

Summary of internal validity:

We believe the internal validity of the study was good. We think that the most significant threat to the study was that there was no adequate follow-up of the subjects. The subjects were tested three months postoperatively, however we do not believe this was enough time and the subjects should have been evaluated an additional time, at least six months post-operation. Through our experience, patients undergoing total hip arthroplasties require at least six to twelve months to fully recover. We believe that there could be additional important information if outcome measures were evaluated six months to one year postoperatively.

The other threat to the study was that the subjects and therapists were not blinded. As mentioned by the previously, it is difficult to blind the subjects, as the subjects were aware of which group they were a part of. The authors also stated that the therapists executing preoperative physical therapy and postoperative physical therapy were the same people,

however they were not performing outcome measures. The last threat to the study was that the authors did not state if the allocation of groups was concealed. We assume there was no concealed allocation, which could potentially affect the outcome of the results. The lack of blinding of the subjects and therapists, and the assumption that allocation was not concealed, were only minor threats to the internal validity of the study. All other potential threats to validity were accounted for.

Evidence:

The outcome measures used in this study relevant to our clinical PICO were the Visual Analog Scale (VAS) and Harris Hip Score (HHS). The authors state that the study and control group were both similar at baseline. Throughout the time of the study, the authors compared the study group and control group at different time intervals as mentioned in the outcome measures.

Table 1. Effect size of VAS and Harris Hip Score at Baseline				
	Study Group	Control Group	Effect Size	CI
VAS	6.92 ± 1.97	7.54 ± 1.8	0.33	-0.49 - 1.15
Harris Hip Score	40.89 ± 13.34	35.35 ± 16.21	0.37	-0.45 - 1.20
<i>Note.</i> Baseline measurements were taken 1 day before surgery				

Table 1 represents effect sizes and confidence intervals at baseline. The calculations demonstrate small effect sizes between groups for each VAS (0.33) and HHS (0.37). As both the confidence interval ranges negative to positive numbers, this indicates that we cannot extrapolate from the data which group is favored over another. This supports the author's statement that the groups were similar at baseline.

Table 2. Effect size of VAS and Harris Hip Score at 3 Months Post-operation				
	Study Group	*Control Group	Effect Size	CI
VAS	0.3 ± 0.48	1.27 ± 1.00	1.22	0.33 - 2.11
Harris Hip Score	69.47 ± 7.49	65.2 ± 15.4	0.35	-0.48 - 1.17
<i>Note.</i> Two patients lost from the control group are included in this analysis				

Table 2 represents effect sizes and confidence intervals for the scores at three months post-operation. The HHS has a small effect size, however the confidence interval range from

negative to positive values, indicating that there cannot be an assumption that one group favored over another from the treatment. However, the VAS had a large effect size, with a confidence interval ranging from moderate to very large effect sizes, 0.33 – 2.11. This complements the author's statement that the study group had significantly less pain as rated by the VAS ($p = 0.03$). All effect sizes and confidence intervals were calculated through the information the author presented.

MCIDs were not given for the outcome measures used by the authors (VAS and Harris Hip Score), however MCIDs were derived from Achen et al. 2010¹ and Lee et al. 2003² for the Harris Hip Score (7 points) and VAS (19 mm), respectively. Both groups met MCID requirements for improvement regarding VAS and HHS from baseline to discharge. The authors also state that all groups had within-group improvements at all assessment times and with all outcome measures.

Applicability of study results:

Benefits vs. Costs:

The comparison of benefit versus the cost of preoperative education and therapy prior to a total hip arthroplasty needs to be considered. The results of the study demonstrates that a preoperative plan prior to a total hip arthroplasty can benefit in short term reduction of pain, however will not increase functionality. Pain is a large component to consider after a total hip arthroplasty. According to the results of the study, we do not believe that the decrease in pain and no effect on functionality of the hip, overcomes the cost of the study.

The amount of time spent with the physiotherapist (60 minutes/day, 5 days/week, for 4 weeks) must be taken into respect. This reduces the amount of time the physiotherapist has to give to other patients. The amount of time has to be considered in terms of the patient as well. For patients with primary end-stage osteoarthritis, it is a large time commitment to come in as frequent as the study is designed. A benefit to the study was that the equipment used seemed relatively simple and accessible, no additional equipment would need to be purchased for the exercise protocol.

Feasibility of Treatment:

We do not think the feasibility of the treatment can realistically be applied to the clinical setting. The authors describe the intervention protocol well enough that it is reproducible and applicable. However the time commitment is the largest issue for multiple reasons. As mentioned in the previous section, this would be a very large time commitment and the likelihood that patients would be willing to come in five days per week for one month is unlikely.

Additionally, the treatment would likely not be covered by insurance, especially since results show that there is no significant improvement in function and only a significant reduction in pain. However, we believe this is where the inadequate follow-up will affect results. The groups were evaluated at three months post-operation, and we believe that the authors should have evaluated the groups at least one more time in order to determine whether long term benefits were present.

The last consideration about the feasibility of the treatment is the intensity of the treatment protocol. The likelihood that patients with end-stage hip osteoarthritis would be compliant with a five hour per week, for four weeks, preoperative physical therapy program is low. Patients independently going through the exercise protocol would likely be limited by their pain.

Summary of External Validity:

We do not think that the threats to internal validity compromise the ability to generalize these results. The largest threat to internal validity was an inadequate follow-up, which could show further evidence to indicate or contraindicate the use of a preoperative physical therapy intervention. The patient population used in this study is applicable to the population receiving a total hip arthroplasty for a variety of reasons, not just osteoarthritis.

Article: Gocen et al (2004)**Clinical Bottom Line:**

Preoperative physical therapy does not appear to be more effective for pain control or for long-term benefits of hip function when compared to postoperative therapy. The study group received strengthening and range of motion exercises including straight leg raises, hamstring and hip flexor stretches, upper extremity exercises and an educational program eight weeks before surgery. The control group did not receive any preoperative physical therapy or education. Both the control group and the study group met within-group MCID's for the Harris Hip Scores (HHS). The MCID's for the VAS, however, were not met. The VAS values between groups at discharge were not statistically significant ($p=0.54$ at rest and $p=0.89$ with activity). The Harris Hip Scores between groups immediately preoperatively and at 24 months postoperatively weren't statistically significant ($p=0.13$ and $p=0.28$). The Harris Hip Scores between groups at discharge and three months postoperatively were statistically significant ($p=0.007$ and $p=0.02$ respectively). Moderate effect sizes for the HHS existed at discharge and three months postoperatively between groups. Small effect sizes existed immediately preoperatively and two years postoperatively. Threats to internal validity included a lack of similarity between patients at baseline, lack of blinding the patients, and a lack of adequate power. Even with these threats to the study, the results can still be applied to patients undergoing a total hip replacement (THR). This study did suggest possible short term benefits and an earlier functional recovery time with those who received preoperative physical therapy.

Article PICO:

Population— The population in this study included 59 subjects (21 men and 38 women; mean age 51.3 years) with primary or secondary hip osteoarthritis undergoing a total hip replacement (THR). Patients were excluded from the study if they had any other joints with osteoarthritis requiring treatment or if they had a chronic disease.

Intervention— The study group received pre-operative physical therapy including straight leg raises, hamstring and hip flexor stretches, and upper extremity strengthening exercises. The intervention group was also provided with an education program including advice on the use of assistive equipment such as crutches and elevated beds, advice on movements to avoid, lifting and carrying advice, and postural alignment. This group received a post-operative protocol including education as well.

Comparison—The control received post-operative physical therapy and an education program beginning the day following surgery. This same protocol was also provided to the study group.

Outcomes—The outcomes of this study were measured using the Harris Hip Score and the visual analogue scale (VAS) at eight weeks prior to operation, immediately preoperatively, at discharge, three months postoperatively and 24 months postoperatively. Other outcome measures included hip abduction (degrees) and functional activities including walking, climbing stairs, and bed/chair/toilet transfers. The functional activities were measured the first day patients attempted these activities postoperatively.

Blinding:

Blinding did occur for the therapists who performed all of the postoperative measurements and assessments; however, the subjects were not blinded in this study. Blinding of the subjects would have been very difficult to perform. Since blinding of the subjects did not occur, this study could potentially be at risk for experimental biases such as the Hawthorne effect or the Rosenthal effect.

Controls:

The control group was provided with a standard postoperative total hip replacement protocol described by *Flanagan et al.*³ Both the control group and the study group received the same postoperative training and education. No placebo group was used in this study. The control group was appropriate for this study because the only difference between the control group and the study group could be attributed to the intervention treatment being studied. One caveat to the control group being appropriate, however, could be attributed to the age difference between the control group and the study group.

Randomization:

Randomization in this study did occur using a table of random numbers on an Excel computer program. Odd numbers were allotted to the study group and even numbers were distributed to the control group. The randomization process was not concealed. Furthermore, randomization was not successful because the mean age of the study group was significantly younger than the control group. Similarities did exist between groups at baseline including body mass index, male to female ratio, and immediate preoperative Harris Hip Score.

Study:**Study Design:**

This study was a randomized controlled trial which compared the effectiveness of preoperative physical therapy for patients receiving a total hip replacement (THR) versus conventional postoperative physical therapy.

Subjects:

This study involved 59 subjects (21 men, 38 women, mean age 51.3 years) scheduled for a THR with a thrust plate prosthesis. The inclusion criteria involved 29 patients with primary hip osteoarthritis and 30 patients with secondary hip osteoarthritis. The causes of hip osteoarthritis included developmental dysplasia, idiopathic avascular necrosis, or a fracture. Patients were excluded from the study if they had developed osteoarthritis in any other joints which would require treatment or if they had acquired a chronic disease. Out of the 59 patients, 29 were assigned to the study group who received the preoperative physical therapy including straight leg raises, hamstring and hip flexor stretches, upper extremity strengthening, and education on assistive devices and movements. The other 30 patients were assigned to the control group which was given a standard postoperative physical therapy protocol and education.

The study group was required to perform the straight leg raises, hamstring and hip flexor stretches and upper extremity strengthening exercises three times per day with 10 repetitions for eight weeks prior the THR surgery. These exercises were evaluated by a physical therapist every two weeks. The educational program the study group received involved teaching specific movements to avoid, using assistive devices like a raised toilet seat, raised bed, crutches and forceps to aid in dressing. Both the study and the control group received postoperative treatment and education which was not specifically described in the article.

Outcome measures:

The outcome measures relevant to my clinical population were the Hip Harris Score, the visual analogue score (VAS) for pain, and the functional analysis of activities. The Harris Hip Score outcomes were measured at eight weeks prior to the surgery, immediately preoperatively, at discharge, three months postoperatively, and 24 months postoperatively. The VAS was measured at discharge and functional activities were measured the first day the activity was started postoperatively. Neither the reliability nor validity was addressed in the study by the authors. According to Soderman P. et al (2001), the Harris Hip Score showed high validity and reliability for patients postoperative THR. According to Brokelman et al (2012), the VAS has high validity and

reliability. The authors did not report intra- and/or inter-rater reliability from other studies. The authors did not discuss a threshold for the minimal clinically important difference (MCID) for the outcomes of interest. According to Lee et al (2002), the MCID for the VAS was set at 19 mm. According to Achten et al (2010), the MCID for the Harris Hip score was set at 7 and 10 depending on different power levels of 80 to 90%.

Study losses:

All subjects were analyzed in the groups to which they were randomized. The study group lost one participant after the 8 week assessment prior to surgery due to cardiovascular complications, but no other subjects dropped out. Since only one subject was lost in the study, an intention-to-treat analysis was not necessary. The authors stated that the VAS was evaluated at discharge, three months and two years after the surgery, but the authors only reported VAS data at discharge.

Summary of internal validity:

This study had fair internal validity. A major threat to the internal validity of this study was a difference of the mean ages between the study group and the control group. The study group was significantly younger ($p < 0.01$) than the control group. This could lead to possible skewed outcome measures. Also, the subjects in the study were not blinded. This is a moderate threat to internal validity. Since blinding did not occur to the subjects, the study could be threatened by the Hawthorne effect or the Rosenthal effect. The number of subjects in the study could also present as a moderate threat to internal validity. Inadequate power could result from a smaller number of 60 participants. This study did, however, blind the physical therapists that performed the measurements and assessments. The study also had only one drop out which wouldn't require an intention-to-treat analysis. All other threats appeared to be accounted for, which led to the fair internal validity of the study.

Evidence:

The outcome measures that were most applicable to my clinical question were the Harris Hip Score, the VAS and functional activities. All of the following calculations were performed using the data that the authors presented.

The differences between the control group and the study group for the Harris Hip Score was not significant ($p > 0.05$) between the groups immediately preoperatively or 24 months later. Significant differences ($p < 0.05$) were noted between the study group and the control group at discharge ($p = 0.007$) and three months postoperatively ($p = 0.02$). Significant improvements occurred for the physical therapy group eight weeks prior to surgery when compared within that group ($p = 0.001$).

The VAS data was only provided at discharge. The mean difference for the VAS scores between the study group and the control group at discharge wasn't statistically significant ($p>0.05$).

The differences between the study group and the control group was presented by measuring five functional activities including walking, climbing stairs, bed transfers, toilet transfers and chair transfers. The measurement of these functional activities was recorded by the number of days after surgery the activity was attempted. The study group initiated all activities one day earlier than the control group except with walking, which was completed on the same day. A statistically significant difference was noted between the all functional activities except for walking ($p<0.05$).

Table 1. Effect Size of Harris Hip Score at Various Time Intervals

	Control Group	Study Group	Effect Size	CI
Immediate Preoperative	45.30 ± 12.98	51.48 ± 18.32	0.46	-0.06 - 0.98
Discharge	59.36 ± 6.82	64.46 ± 6.92	0.74	0.21-1.27
3 months Postoperative	78.70 ± 9.41	85.30 ± 11.78	0.62	0.10-1.14
24 months postoperative	95.66 ± 6.08	97.14 ± 4.32	0.28	-0.23 - 0.79

Note. Medium effect size at least 0.3 and large effect size at least 0.5

At discharge and three months postoperatively, the groups had a moderate effect size. Immediately preoperatively and at 24 months postoperatively, the groups had a small effect size. For the immediate preoperative and 24 months postoperative effect sizes, the confidence intervals were negative indicating the changes between groups could be due to either the study group or the control group.

Applicability of study results:

Benefits vs. Costs:

The financial costs to benefits ratio of this treatment need to be considered. Preoperative physical therapy would add additional cost to an expensive surgery. Another consideration is whether insurance will cover preoperative physical therapy treatments. The patients must also be willing to dedicate more time to the entire rehab process and depending of their age, budget, transportation and other work requirements, this may or may not be feasible. This study suggested preoperative physical therapy was beneficial for a short period of time, but the longer lasting effects of the intervention were not different. There may also be a quicker return to functional activities with the intervention group for stair climbing ($p=0.01$), bed transfers ($p=0.02$), toilet transfers ($p=0.02$) and chair transfers ($p=0.001$). A few benefits of

this intervention include that it doesn't require any additional equipment. A patient could also practice many of these activities addressed in the study on their own time with an appropriate home exercise program (HEP). These strengthening and stretching activities are also safe interventions which did not cause any adverse events due to the treatment.

Feasibility of treatment:

The interventions presented for the groups in the study can easily be applied in any clinical setting. An increased duration of physical therapy appointments would be required and a greater time commitment would also be necessary for this intervention to occur. Depending on the insurance company, preoperative physical therapy may not be covered especially if evidence based studies are not showing an increased long-term benefit of the intervention. Adherence to an HEP is also essential in order to attain benefits of the intervention. Although the study did not mention painful effects of treatment, the intervention should not be painful or harmful to the patients. The study did explain the exercises performed by the patients but not well enough to be reproduced.

Summary of external validity:

The study population excluded patients with arthritis in other joints and patients with chronic diseases. The population in this study also had a body mass index (BMI) ranging from 24.94-27.69. We feel this subject sample may be less applicable to the range of more complex patients we may encounter with multiple co-morbidities and often higher BMIs receiving a THR. However, this study can be generalized to a more broad population of people with fewer medical complications receiving a THR.

Article: Vukomanovic, A. et al. 2008**Clinical Bottom Line:**

Preoperative physical therapy and education does not improve long-term postoperative pain and function. The study group received preoperative physical therapy and education as opposed to no intervention for the control group. Both groups were similar at baseline, at discharge, and 15 months postoperatively ($p > 0.05$). However, the study group was able to return to functional activities much quicker ($p < 0.05$) than the control group. Minimal clinical importance differences (MCID) were not given for the outcome measures used by the authors (Visual Analog Scale, Harris Hip Score, distance walked, and nine functional activities), however, MCIDs were derived from Achen et al. 2010¹ and Lee et al. 2003² for the Harris Hip Score (7 points) and VAS (19 mm), respectively. Both groups met within-group MCIDs for the visual analog scale (VAS) and for the Harris Hip Score (HHS), but the pre-operative group was not significantly better than the post-operative group.

The authors failed to blind the subjects, therapists, or assessors of the study and lacked baseline comparability. This was the greatest threat to the study as biased therapists and assessors could have led to biased results. We do not believe that this threat to internal validity had a significant effect on the outcome and external validity. Although pain may not be decreased, quicker return to function can be derived from the results and can be beneficial to the patient.

Article PICO:

Population— The population used for this study were patients 70 years old or younger, with primary or secondary hip osteoarthritis eligible for a total hip arthroplasty.

Intervention— The intervention used on the study group was preoperative consultation with the physiatrist and two physiotherapy classes (focus on exercises and functional activities).

Comparison— The control group received no preoperative education or therapy. The control group received the same post-operative protocol as the study group.

Outcomes— The outcome measures used were the VAS, hip ROM, Harris Hip Score, hip score of the Japanese Orthopaedic Association, and the Oxford Hip Score.

Blinding:

There was no blinding of the subjects, therapists, or assessors. Due to the nature of this study design, it would be difficult to blind the subjects or the therapist. The authors did not state whether the therapists were also the assessors, for that reason, we assumed the assessors were not blinded. The largest threat to blinding is not blinding the assessors. If the assessors were not blinded to the study, then there is the possibility that they might bias their outcome measures.

Controls:

The control group did not receive any preoperative education or treatment, however they did receive identical post-operative rehabilitation to the study group. This was an appropriate control group as there was no differences between groups ($p > 0.05$).

Randomization:

The assignment of subjects to the study and control group was randomized, however the randomization was not concealed nor stratified. The randomization process failed to successfully divide groups as there were significant differences between the control and study group ($p < 0.05$).

Study:Study Design:

This was a randomized controlled trial comparing the effects of a preoperative total hip arthroplasty education and therapy program with post-operative rehabilitation to a standardized post-operative rehabilitation program.

Subjects:

The study included 45 total patients, 23 in the study group and 22 in the control group. These patients were required to: have a diagnosis of primary or secondary hip osteoarthritis, be younger than 70 years old, be able to ascend and descend stairs, walk without the use of crutches, have had no experience with the use of crutches, and have had no comorbidities (i.e. cardiovascular, neurological, musculoskeletal, respiratory, or cognitive diseases). All patients were randomly assigned to either the study or control group. The study group received preoperative education and therapy, while the control group did not. Both groups received identical post-operative rehabilitation.

Outcome Measures:

The outcome measures used were the VAS, Harris Hip Score, distance walked, and functional assessment based on their abilities to perform nine basic activities at the end

of each day of their rehabilitation in the hospital (supine to side lying, supine to sit, sit to stand, standing, back to bed, walking with crutches, use of toilet, sitting on chair, and ascent/descent of stairs). Their criteria to grade walking endurance are as followed: 0 – does not walk, 1 – at least 5 meters, 2 – at least 15 meters, 3 – at least 50 meters, 4- 100 meters, 5 – greater than 100 meters. Their criteria to grade the functional activities was based on a 0 – 5 scale: 0 – the patient cannot perform the activity, 1 – the patient requires maximum assist, 2 – the patient requires minimum assist, 3 – the patient requires verbal cues, 4 – patient performs activity independently but insecurely (requires someone nearby), and 5 – patient performs independently and securely. The authors performed the outcome measures prior to admission, each day of their hospital stay, at discharge, and 15 months post-operation. The authors did not discuss the MCID for the VAS or Harris Hip Score, nor state the reliability and validity of the test measures. MCIDs were derived from Achen et al. 2010¹ and Lee et al. 2003² for the Harris Hip Score (7 points) and VAS (19 mm), respectively. The authors also did not discuss interrater and intrarater reliability of their study, which could further affect the results of the study.

Study Losses:

A total of 45 patients were accepted into the study. 5 of the 45 patients were excluded from the study due to intraoperative and postoperative complications. An additional four patients were lost as they were not assessed at 15 months postoperatively. All patients were analyzed in their respective groups to which they were randomized, however due to the amount of patients lost during the study, an intention-to-treat analysis should have been performed but was not.

Summary of internal validity:

This study contained a few threats to validity. We believe the most significant threat to the study was that there was no blinding to the subjects, therapists, or assessors. It is difficult to blind the subjects, as the groups either received an intervention or did not. However, an assumption was made since the authors did not state whether the therapists or assessors were blinded. This poses a threat to the validity of the study as the study group could have been biased towards increased improvement. The authors do not state whether the therapists treating the patients during their hospital rehabilitation, are consistent on a day-to-day basis, or whether the therapists treating the patients are also the assessors at discharge and at 15 months post-operation.

Another threat to the study was that an intention-to-treat analysis should have been performed, however was not. Greater than 15% of the patients recruited for the study (9/45) were lost throughout the study due to postoperative complications. These could possibly lead

to skewed results as all the patients were not all completely analyzed to their allocated groups, especially at discharge and 15 months post-operation. A minor threat to the study was that concealed allocation was not performed, as it could affect how the two different groups were formed. Additionally, another threat to the study includes the failure of a successful randomization. As the patients were not considered similar, results could possibly be due to the group differences rather than the intervention.

Although these threats are present throughout the study, we believe that the internal validity to this study was fair. The largest threat was the lack of blinding to the patients, therapist, and especially the assessors. As mentioned, it is difficult to blind the patients and the therapists, however lack of blinding the assessors posed the greatest threat, as they could have biased the results of the study. All other possible threats to validity were accounted for.

Evidence:

The outcome measures used in the study that are relevant to our clinical PICO are the VAS, Harris Hip Score (HHS), and the patient's ability to perform the nine functional activities mentioned in the study design. However, we also examined the Oxford Hip Score (OHS) as Achen et al. 2010 describes the OHS and HHS as similar test measuring the same characteristics of hip function.

Table 1. Effect size of VAS, Harris Hip Score, and Oxford Hip Score at Admission				
	Control Group	Study Group	Effect Size	CI
VAS at Rest (mm)	33.5 0 ± 29.09	37.45 ± 25.34	0.15	-0.84 - 1.14
VAS Movement (mm)	71.95 ± 15.31	69.9 ± 19.11	0.12	-0.44 - 0.73
Harris Hip Score	45.75 ± 11.82	44 ± 7.25	0.18	-0.41 - 0.77
*Oxford Hip Score	38.85 ± 8.01	44.75 ± 5.76	0.85	0.24 - 1.46
<i>Note.</i> Oxford hip score is not included in our clinical PICO				

Table 1 represents the effect size and confidence intervals at admission for the VAS, HHS, and OHS. There is a small effect size for the VAS at rest (0.15) and with movement (0.12), as well as HHS (0.18). These small effect sizes complement *p-values* given by the author supporting that both groups were similar ($p>0.05$). As their confidence intervals range from negative to positive values, this is indicative that both groups were similar and outcomes cannot be favored towards one group. However, there was a large effect size of 0.85 in favor of

the study group for the HHS, stating that the OHS was the only test that had a significant higher score compared to the control group ($p < 0.03$).

Table 2. Effect size of VAS, Harris Hip Score, and Oxford Hip Score at Discharge				
	Control Group	Study Group	Effect Size	CI
VAS at Rest (mm)	6.20 ± 14.95	3.95 ± 13.08	0.16	-0.49 - 0.81
VAS Movement (mm)	11.50 ± 17.33	10.25 ± 17.33	0.07	-0.58 - 0.73
Harris Hip Score	50.10 ± 6.17	51.25 ± 8.17	0.16	-0.50 - 0.81
*Oxford Hip Score	17.59 ± 7.84	17.06 ± 6.1	0.08	-0.58 - 0.73
<i>Note.</i> Oxford hip score at discharge was taken 15 months postoperative				

Table 2 represents effect sizes and confidence intervals at discharge. All scores including the VAS, HHS, and OHS, had small effect sizes ranging between 0.07 and 0.16. These small effect sizes complement the author's findings, as they stated there was no significant difference between groups in regards to these scores ($p > 0.05$). All the confidence intervals range from negative to positive values, indicating that the outcomes of the scores cannot be favored towards one group. All effect sizes and confidence intervals from table 1 and table 2 were calculated through information presented by the authors.

MCIDs were not given for the outcome measures used by the authors (VAS, Harris Hip Score, and nine functional activities), however MCIDs were derived from Achen et al. 2010¹ and Lee et al. 2003² for the Harris Hip Score (7 points) and VAS (19 mm), respectively. Both groups met MCID requirements for improvement regarding VAS and HHS from baseline to discharge.

The main differences between groups are present throughout the tests of the nine functional measures that the authors tested. Both groups initiated ambulation at the same time ($p = 0.08$), however patients in the study group began to use the toilet, chair, and stair mobility significantly before the control group ($p < 0.05$). The study group began these activities approximately one day before the study group.

The authors continued to look at the differences between groups at the third day after the operation and at discharge. The study group received higher scores on the 0-5 scale compared to the control group on the third day after the operation and at discharge ($p < 0.05$). By the day of discharge, virtually all patients in the study group were independent with their nine functional activities, while most patients in the control group continued to require assistance with their activities.

Applicability of study results:Benefits vs. Costs:

The benefits versus costs consideration would be a factor in determining whether a preoperative intervention plan should be used prior to a total hip arthroplasty. Although there was an immediate improvement in the study group postoperatively, the long term effects of the intervention were not comparable. One can argue that a more expedited return to functional activities is beneficial. Another consideration is the increased time of preoperative visits to the physiatrist, therapists, and patients. Patients affected by primary or secondary hip osteoarthritis are likely to experience significant amounts of pain; their pain is likely to prevent them from attending frequent physician and physical therapy visits. The physical therapist and physiatrists would be required to allocate more time to preoperative patients, ultimately having less time for other patients. A benefit to the study is that there is no need for any additional equipment.

Feasibility of Treatment:

The ability to apply the intervention to the clinical setting is very realistic and feasible. The caveat to preoperative education and therapy, is the increased amount of visits prior to the total hip arthroplasty in the physiatrist and physical therapists' office. The likelihood that insurance would cover preoperative physician and physical therapy visits is low, especially with low evidence that long term outcomes are not different compared to standard postoperative rehabilitation. Although we believe the preoperative education will do no harm to the patient, and as long as the patient is compliant to the education, it is likely that they will return to functional activities quicker. The study did not explain what the exercise prescription entailed, however we assume that the treatment was not painful and is feasible for future patients to perform at home.

Summary of External Validity:

We believe that the threats to internal validity do not compromise the ability to generalize these results. Some of the threats to the study were inevitable and the other possible threats were controlled and accounted for. The population used in this study matches the population that we addressed in our clinical PICO. We believe that the results from this study can also be generalized to a variety of populations who are receiving a total hip arthroplasty or any hip surgery.

Synthesis/Discussion:

Based on these three articles, we believe that preoperative physical therapy and education does not improve long-term pain and overall hip function after a total hip arthroplasty. However, the studies do show that there is evidence of short-term effects of preoperative physical therapy and education. Of the three studies, Gocen and Vukomanovic's results demonstrate quicker returns to functional activity in patients who received preoperative physical therapy and education. Nonetheless, long term effects of the intervention had no effect on pain and overall hip function.

Ferrara *et al.* and Gocen *et al.* received PEDro scores of 6/10 and Vukomanovic *et al.* received a PEDro score of 4 /10. These are all fair rankings for PEDro scores, each with their respective threats to internal validity. All three articles lacked blinding of the subjects and the therapists. This would have been a difficult task to accomplish due to the nature of the study. Vukomanovic et al was the only study that did not blind their assessors, which could have led to biased results.

All patients from the studies met our clinical population that we are investigating. The study by Gocen *et al.* was the only group to not have similar baseline characteristics between groups – the study group had a lower average age compared to the control group, which could explain the quicker return to functional activity compared to the control group. Regardless of this failure of randomization, Vukomanovic *et al.* also demonstrates quicker returns to functional activity as compared to the control groups ($p>0.05$). Based on these two articles, we derived from the studies that preoperative physical therapy and education has benefits for a faster recovery of function.

Although the evidence supports quick return to function, there is no beneficial long-term effect. The studies demonstrate at the last day of measurement, whether it was three months postoperative (Ferrara *et al.*) or two years postoperative (Gocen *et al.*), that Harris Hip Scores were no different between study and control groups. All groups met MCID requirements for improved Harris Hip Scores. All groups also met MCID requirements for improved pain as measured by the VAS. However, the only study to show a larger reduction of pain via the VAS was the study by Ferrara *et al.*

Based on these articles and their study designs, we believe that preoperative physical therapy and education will not benefit patients undergoing a total hip arthroplasty. However, this treatment may result in a faster return to function and possibly an increased reduction of pain.

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